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ВЗАИМОСВЯЗЬ ЯЗЫКА И МОЗГА: КАК ПОВЫСИТЬ ЭФФЕКТИВНОСТЬ ОБУЧЕНИЯ ИНОСТРАННОМУ ЯЗЫКУ ПРИ ПОМОЩИ НЕЙРОЛИНГВИСТИЧЕСКОЙ МЕТОДОЛОГИИ

В современном мире владение английским языком стало ключевым навыком для эффективной коммуникации и карьерного роста. В данной статье рассматриваются вопросы интеграции методологии нейролингвистических исследований в процессы преподавания английского языка как иностранного (TEFL) и совершенствования профессиональной коммуникации. Используя последние достижения в области нейролингвистики, автор исследует нейронные механизмы, лежащие в основе обработки языка, билингвизма, языковых расстройств, а также их влияние на изучение языка и коммуникацию. В статье представлен обзор ключевых публикаций в данной области и освещена специфика методологии нейролингвистических исследований. Цель статьи -

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показать, как нейролингвистические методы позволяют получить ценные сведения об изучении языка, а также сформировать стратегии обучения и профессиональной подготовки. Автор демонстрирует, как измерения электрической и гемодинамической активности мозга, айтреккинг и компьютерное моделирование выявляют когнитивные процессы усвоения и использования языка в речи. В статье показано, что эти данные позволяют преподавателям адаптировать свои методы и программы обучения в соответствии с возможностями мозга по обработке естественного языка. Исследование отражает потенциал интеграции нейролингвистической методологии, обеспечивающей связь между нейронаукой и языковым образованием. Полученные результаты подчеркивают перспективность этого междисциплинарного подхода, обеспечивающего более эффективное и увлекательное изучение языка. Данная работа вносит вклад в понимание того, как нейролингвистическая методология может качественно изменить языковое образование и профессиональную коммуникацию, предлагая новые способы оптимизации стратегий обучения и содействия эффективному речевому взаимодействию на иностранном языке.

Ключевые слова: нейролингвистика, языковое образование, профессиональная коммуникация, механизмы обработки информации мозгом, стратегии обучения, когнитивная нейронаука, усвоение языка

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BRIDGING BRAIN AND LANGUAGE: ENHANCING LANGUAGE LEARNING AND COMMUNICATION THROUGH NEUROLINGUISTIC INSIGHTS

In today’s interconnected world, the proficiency of English has become a pivotal skill for effective communication and career advancement. This paper delves into the integration of neurolinguistic methodology into teaching English as a foreign language (TEFL) and

enhancing professional communication. By leveraging recent advancements in neurolinguistics, the author explores the neural mechanisms underlying language processing, bilingualism, language disorders, and their implications for language learning and communication. The paper presents a comprehensive review of key publications in the field and elucidates the multifaceted methodologies employed in neurolinguistic research. The study aims to uncover how neurolinguistic methods offer valuable insights into language learning and communication, shaping instructional strategies and training programs. The author investigates how brain electrical and hemodynamic activity measurements, eye tracking, and computer modeling illuminate the cognitive processes of language acquisition and use. The paper reveals that these insights empower educators to tailor their teaching methods and training programs to align with the brain's natural language processing capacities. The research identifies the transformative potential of integrating neurolinguistic methodology, providing a bridge between neuroscience and language education. The findings underscore the promise of this interdisciplinary approach, offering a more effective and engaging language learning experience for learners and professionals alike. This paper contributes to the understanding of how neurolinguistic methods can reshape language education and professional communication, offering novel perspectives on optimizing learning strategies and facilitating effective communication in the globalized world.

Keywords: neurolinguistics, language learning, professional communication, brain processing mechanisms, teaching strategies, cognitive neuroscience, language acquisition

Introduction

In today's interconnected world, proficiency in English has become increasingly essential for effective communication and career advancement. As educators and professionals strive to optimize language learning processes, innovative approaches rooted in neuroscience are emerging as game-changers. One such approach is the integration of neurolinguistic methodology, which leverages our understanding of the brain's language processing mechanisms to enhance the efficiency and effectiveness of teaching English as a foreign language (TEFL) and improving professional communication skills.

Neurolinguistics, at its core, investigates how the brain comprehends, produces, and adapts to linguistic information across various levels, from phonetics to pragmatics. By employing a diverse range of neurophysiological measurement techniques and computational modeling, researchers gain invaluable insights into the intricacies of language learning and the factors influencing its success. These methodologies offer objective and quantifiable data, shedding light on the cognitive processes and neural networks engaged during language acquisition.

By harnessing the power of neurolinguistic methods, educators can unlock a deeper understanding of how learners absorb and internalize English language skills. This knowledge empowers instructors to tailor their teaching strategies, incorporating evidence-based practices that align with the brain's natural language processing capacities. From phonological awareness to syntactic comprehension and discourse production, a neurologically-informed approach provides a solid foundation for designing engaging and effective English language curricula.

Moreover, neurolinguistic methodology holds great potential for addressing challenges faced by professionals seeking to improve their English communication skills in the workplace. With an emphasis on individual differences, motivation, and cognitive processing, this approach enables targeted interventions tailored to the specific needs of adult learners. By leveraging neuroimaging techniques such as functional magnetic resonance imaging (fMRI) and functional near-infrared spectroscopy (fNIRS), researchers can identify the neural substrates associated with successful professional communication. This knowledge can inform the development of specialized training programs, empowering individuals to navigate diverse workplace scenarios with confidence and proficiency.

Research in the field of neurolinguistics is at the forefront of scientific advancements, bridging the gap between natural sciences and linguistics. While in previous decades it primarily focused on clinical research related to brain function disorders such as aphasia and dyslexia, its current emphasis is on exploring the brain's functioning in individuals without clinical impairments. This includes investigating the brain's response to the acquisition of new sign systems, including foreign languages. A particular area of interest lies in studying bilingual and

multilingual individuals who have acquired second or subsequent languages naturally or through instruction.

One of the key priorities within this context is understanding brain plasticity, encompassing various aspects such as the formation and dynamics of neural connections during the learning process of foreign languages and cultures, the integration of language behavior with corresponding neural patterns, and the differences in the development of language competence based on language acquisition conditions (Nguyen-Phuong-Mai, 2021). Although brain plasticity enables language learning throughout one's lifetime, there are indications that the processes associated with neuroplasticity differ between individuals who acquire languages naturally and those who learn them through instruction. This suggests variations in the activation of neurons during the processing and reproduction of assigned tasks.

In this comprehensive context, there is promising potential for neurolinguistic experiments aimed at diagnosing and enhancing cognitive abilities, particularly in relation to professional skills such as memory, logical reasoning, critical analysis, and imagination. Additionally, investigating the brain's processing of specialized creolized texts remains an important area of inquiry.

By conducting empirical and theoretical research on the mechanisms underlying speech production and perception in both native and foreign languages, while considering behavioral factors within socio-cultural environments, we can deepen our current understanding of discursive practices across different languages and cultures. This cross-cultural approach integrates several disciplines, including neurolinguistics, cognitive linguistics, psycholinguistics, intercultural communication, and translation studies, with a specific focus on the mental processes involved in translation.

Within this expansive scope, conducting neurolinguistic experiments to assess the speed and efficiency of reading processes at different stages of foreign language acquisition, exploring the neurolinguistic aspects of professional communication, investigating the processes of generating and perceiving oral and written texts, advancing neurolinguistic research and cognitive modeling of foreign language acquisition processes, offering a neurolinguistic interpretation of experimental results during oral translation, and comparing neural patterns in stimulus processing

between bilingual and multilingual individuals are promising directions for future research.

As the field of neurolinguistics continues to advance, its integration into language learning pedagogy and professional development holds immense promise for educators, learners, and professionals alike. By leveraging the power of the brain's innate language processing abilities, we can revolutionize the way English is taught and communicated, empowering individuals to excel in a globalized world.

The aim of this paper is to provide a comprehensive exploration of the integration of neurolinguistic methodology into the realms of teaching English as a foreign language (TEFL) and enhancing professional communication. By examining the advancements in neurolinguistics, delving into various neurophysiological measurement methods, and discussing the potential application of neurolinguistic insights in language learning and communication, this paper seeks to illuminate the opportunities and challenges presented by this interdisciplinary approach.

Neurolinguistics: advancements and problematics

The field of neurolinguistics has experienced significant progress in recent years, with a plethora of publications contributing to our understanding of the neural underpinnings of language and its implications for language learning and communication. Researchers have delved into diverse aspects of neurolinguistics, including language processing, bilingualism, language disorders, and the application of neurolinguistics in education and communication. Key publications have shed light on these areas, offering valuable insights for scholars, educators, and practitioners.

One of the fundamental works in neurolinguistics is Ahlsén's (2006) introduction, which covers topics such as language processing, brain imaging techniques, and language disorders. This work provides a comprehensive overview of the field and its core principles.

Another important publication is Baggio's (2022) contemporary perspective, which explores the neural mechanisms underlying language production and comprehension. This publication integrates the latest research and methodologies and offers insights into the cognitive processes involved in language use.

Bouton (2012) provides a historical and theoretical perspective on neurolinguistics, tracing its development and theoretical foundations.

This publication examines the evolution of the field and its key concepts and provides a valuable context for understanding the neural basis of language.

Some publications showcase the application of neurolinguistics in assistive technology, such as Cooney et al.'s (2018) research on direct-speech brain-computer interfaces. Their work demonstrates the potential for using neurophysiological signals to facilitate communication for individuals with speech disabilities.

A comprehensive resource in neurolinguistics is The Oxford Handbook of Neurolinguistics edited by De Zubicaray and Schiller (2019), which features contributions from leading experts in the field. This handbook covers a wide range of topics, including language acquisition, bilingualism, language disorders, and neuroimaging techniques, providing researchers and practitioners with a rich source of information.

Egamberdiyeva (2022) explores the intersection of neurolinguistics and foreign language teaching in higher education. This publication discusses the potential benefits of incorporating neurolinguistic insights into language instruction to enhance the learning process and improve language proficiency among students.

Fabbro (2013) focuses on the neurolinguistics of bilingualism, investigating the cognitive and neural processes involved in bilingual language processing. This work provides valuable insights into the advantages and challenges faced by bilingual individuals.

Studies by Faruji (2011) have explored the neurolinguistic aspects of second language acquisition. Their research examines the neural mechanisms underlying language learning and sheds light on the cognitive processes involved in acquiring a second language.

These publications, along with others in the field, have contributed to our understanding of the neural basis of language and its implications for language learning and communication. By reading these works, one can gain a deeper understanding of the cognitive processes involved in language use and appreciate the diversity and complexity of human communication.

Methodology of neurolinguistic research

Neurolinguistics is an interdisciplinary science that investigates the functioning of the brain and its properties during speech, thinking, emotional perception, and memory. It emerged in the 19th century

through the pioneering research of P. Broca, who discovered the connection between motor aphasia (the loss of oral speech ability) and damage to a specific region in the left hemisphere of the brain. Since then, neurolinguistics has advanced by incorporating findings from related fields such as neurology, speech therapy, biophysics, biochemistry, molecular biology, and information systems theory.

The aim of neurolinguistic research is to uncover the regularities and mechanisms of language-brain interaction, both in individuals with typical language abilities and those with various speech disorders. This is achieved through the utilization of diverse methods, which can be broadly categorized into three stages: linguistic, neurophysiological, and psychological. The linguistic stage involves analyzing language data obtained from individuals with normal or impaired speech. The neurophysiological stage entails measuring brain activity during speech activities using various instrumental techniques such as electroencephalography (EEG), magnetic resonance imaging (MRI), positron emission tomography (PET), and others. The psychological stage focuses on studying the mental processes underlying speech behavior, such as cognition, memory, attention, and emotions (Crosse et al., 2021; Poeppel, 2014, Böttger & Költzsch, 2019).

Despite considerable progress in neurolinguistics over the past few decades, the field faces several challenges and complexities. One of these challenges is the interpretation of data acquired through neurophysiological methods. For example, determining which brain region is responsible for a specific speech function or understanding the factors that influence the activation of particular areas during speech activities can be challenging. Another issue lies in the heterogeneity of language data obtained from different participant groups. For instance, individuals with aphasia may exhibit highly varied speech patterns based on the type and severity of their impairment, as well as individual idiosyncrasies. Additionally, neurolinguistics must consider the diversity of world languages and their specific characteristics when studying the relationship between language and the brain (Nefdt, 2023).

In this section, we will explore the principal methods and approaches employed in neurolinguistic research.

Invasive and non-invasive methods

There are several methods utilized in neurolinguistic research that can be categorized as either invasive or non-invasive. Invasive methods

involve direct intervention in the brain or its tissues, such as stereotactic electroencephalography (SEEG), deep brain stimulation (DBS), microelectrode recording (MER), or magnetoencephalography (MEG). These methods allow for the measurement of brain activity in deep structures with high spatial resolution, but they come with inherent risks and limitations due to the need for surgical procedures and ethical considerations (Menn, n.d.; Roberts, 2019).

On the other hand, non-invasive methods do not require any intervention in the brain or its tissues and are based on measuring various parameters associated with brain function, such as blood flow, oxygen saturation, magnetic fields, or electric currents. Examples of non-invasive techniques include functional magnetic resonance imaging (fMRI), positron emission tomography (PET), functional near-infrared spectroscopy (fNIRS), transcranial magnetic stimulation (TMS), or transcranial direct current stimulation (tDCS). These methods enable the measurement of brain activity throughout the entire brain, albeit with varying spatial and temporal resolutions. However, they also have their own set of limitations and drawbacks, such as the need for expensive equipment, challenges in data interpretation, or potential side effects (Gaillard, 2017).

Hence, the field of neurolinguistic research encompasses a diverse range of methods, each with its own advantages and disadvantages. The selection of a specific method depends on the research objectives, resource availability, and ethical considerations.

Electroencephalography (EEG)

EEG is a valuable method used to study neurolinguistics, providing insights into how the brain identifies and interprets languages, as well as the underlying neural mechanisms involved in language processing. It allows for the measurement of voltage fluctuations resulting from ionic currents in neurons by placing electrodes on the scalp.

One significant advantage of EEG is its excellent temporal resolution, surpassing other brain imaging techniques like fMRI. With the ability to record brain activity at intervals of milliseconds or less, researchers can examine the fine temporal details of language processing tasks. However, it does have limitations in terms of spatial resolution. The current generated by cortical neurons is dispersed laterally within the skull due to the conductivity properties of various tissues, resulting in a blurring of activation sources on the scalp potential distribution image.

To address these limitations, researchers have focused on high-density EEG imaging and the development of methods to enhance spatial resolution (Issa et al., 2018). By utilizing high-density electrode systems with 64 or 128 electrodes arranged in standard layouts, such as the 10/10 or 10/5 system, more precise spatial information can be obtained. These electrode systems are commonly employed in research labs.

The analysis methods used in EEG are crucial in neurolinguistics. Event-Related Potentials (ERPs) are one such method, which examines brain responses triggered by specific events or stimuli, such as words or sentences. By analyzing the time course of ERPs, researchers can investigate the neural processes associated with language processing. Time-frequency analysis of EEG data is another method that enables the study of oscillatory activity in different frequency bands and its connection to language processing tasks. Additionally, connectivity analysis allows researchers to explore the patterns of connectivity between different cortical areas during language tasks, shedding light on the network dynamics involved in language processing.

The ultimate goal of neurolinguistic research is to enhance our understanding of language localization, the mechanisms underlying the use of multiple languages, and the neural organization of language processing in bilingual speakers. Through the utilization of EEG and its analysis methods, researchers can delve into the intricate details of language processing and discover the neural markers associated with various linguistic phenomena.

It is important to acknowledge that EEG has some limitations and challenges (Ein Shoka et al., 2023; Rashid et al., 2020). Subject movements and external electrical interference can introduce artifacts into the recordings, affecting data quality and interpretation. Additionally, the spatial resolution of EEG is relatively low, making it challenging to precisely locate the sources of electrical potentials in the brain. Efforts have been made to address this challenge through the inverse problem of EEG; however, it relies on approximations rather than definitive solutions. Furthermore, EEG alone cannot directly capture the activity of deep brain structures involved in speech processes, necessitating the use of more invasive methods like stereotactic electroencephalography (SEEG) or deep brain stimulation (DBS).

In summary, EEG is a non-invasive neuroimaging technique with excellent temporal resolution that allows for the study of language

processing. While it has limitations in spatial resolution, advancements in high-density EEG and analysis methods have helped mitigate some of these constraints. Combined with techniques like ERPs, time-frequency analysis, and connectivity analysis, EEG provides valuable insights into the neural mechanisms underlying language processing, contributing to the progress of neurolinguistic research. Researchers must also consider the limitations and complexities associated with EEG, such as potential artifacts, spatial resolution constraints, and the need for complementary invasive techniques to explore deeper brain structures involved in speech processes.

Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) is a non-invasive technique used to obtain detailed tomographic images of internal organs and tissues by harnessing the phenomenon of nuclear magnetic resonance. MRI relies on measuring the electromagnetic response of atomic nuclei, particularly hydrogen nuclei abundant in the human body as part of water and other substances when subjected to a specific combination of electromagnetic waves within a strong magnetic field.

MRI finds wide application in neurolinguistics for studying the structure and function of the brain during speech-related activities, both in healthy individuals and those with various speech disorders. It allows for the acquisition of high-quality images of the entire brain with exceptional spatial resolution and facilitates the measurement of various parameters associated with brain activity, such as blood flow, oxygen saturation, metabolism, and functional dynamics (Hill et al., 2019). MRI encompasses several modalities that serve different purposes:

- Functional MRI (fMRI) is a method used to measure changes in blood flow in the brain that are associated with the activation of specific regions during cognitive or motor tasks. fMRI enables the identification of localized and temporal patterns of functional brain areas responsible for various aspects of speech, including phonetics, lexicon, syntax, and semantics (Myers & Blumstein, 2008).
- Diffusion-weighted MRI (DWI) allows for the assessment of the diffusion (random motion) of water molecules in tissues. DWI provides valuable information about the integrity and orientation of the brain's white matter, which comprises axons - long projections of nerve cells that establish

connections between different brain regions. DWI can detect white matter damage caused by conditions such as stroke, dementia, or aphasia (Gaddamanugu et al., 2022).

- Magnetic Resonance Spectroscopy (MRS) serves as a technique for investigating neurochemistry by measuring the concentration of specific metabolites in tissues. MRS offers insights into the status of neurotransmitters, energy metabolism, or cellular stress in the brain related to various speech disorders (Ip & Bridge, 2022).

Nevertheless, MRI is subject to certain limitations and constraints. Firstly, it requires costly and sophisticated equipment that necessitates professional installation and maintenance. Secondly, MRI requires patients to remain completely still for extended periods, ranging from a few minutes to an hour, which can present challenges for children or individuals with pain or psychiatric conditions. Thirdly, MRI has contraindications for individuals with certain medical implants or non-removable metal objects within their bodies, as the strong magnetic field can cause damage or displacement of these objects.

MRI serves as a crucial tool in neurolinguistic research, providing detailed imaging of the brain's structure and function during speech-related activities. However, it is important to consider the inherent limitations and complexities of MRI when designing experiments, conducting research, and analyzing data.

Eye Tracking

Eye tracking, also known as the analysis of eye movement, is a useful technique employed in neurolinguistic research to measure and record eye movements during experiments with controlled or semi-controlled conditions. It enables researchers to gain insights into how visual attention is intricately linked to language processing, an area of study that has captivated researchers for over a hundred years. Pioneers such as Brewster (1832), Boettner and Wolter (1962), and Campbell and Green (1965) laid the foundation for understanding the fundamental principles of visual attention's impact on human vision and perception.

The human visual system relies on the coordinated functioning of the iris, retina, and eye muscles to form coherent images of the surrounding world. Light entering the eye is transformed into an optical image, which is then converted into electrical signals and processed as valuable information (Artal, 2015). Eye movements play a crucial role in

enhancing visual accuracy and facilitating the reception of light. Additionally, the characteristics of eye movements can provide indications of the processing difficulty associated with the observed content, with longer and more frequent eye movements suggesting higher cognitive demands (Rayner, 1977).

Eye movements exhibit variations across different stages of reading and are closely intertwined with the processing of morphological, syntactic, and semantic-pragmatic information (Liversedge et al., 1998). As individuals engage in reading, their eyes move back and forth multiple times, and the nature and duration of these eye movements offer valuable insights into the ease or difficulty of comprehending the text. This concept forms the basis of Rayner's eye-mind hypothesis (1998).

Within the reading process, eye movements occur within specific time frames and are associated with reading duration. Participants produce fixations, saccades, and regressions as they navigate from the beginning to the end of the text. Researchers employ various metrics to analyze eye movements, including fixation duration, dwell times, first-pass reading time (FPRT), second-pass reading time (SPRT), and total reading time (TRT).

Fixation duration and single fixation duration represent the time individuals spend fixating on specific targets during forward reading movements. Dwell times encompass the overall duration of fixations and regressions within specific text zones. FPRT captures the cumulative fixations on a word or text region before moving on, shedding light on lexical access and visual properties of the text. SPRT consists of fixations that return to previously viewed regions, indicating reprocessing or verification behavior related to pragmatic meanings. TRT encompasses the total time individuals devote to attending to a particular scene, encompassing all the eye movements generated.

These dwell-time metrics are vital for characterizing the reading processes observed through eye tracking and are frequently linked to syntactic, semantic, and pragmatic processing. For instance, first-pass reading time is indicative of lexical recognition processing, while second-pass reading time reflects reanalysis and the need for revising earlier regions in terms of structural analysis.

Despite the invaluable insights eye tracking provides in neurolinguistic research, it is essential to acknowledge its limitations and constraints. Eye tracking necessitates specialized and often expensive

equipment that requires calibration and adjustment for each participant. Moreover, it requires participants to maintain relative head immobility throughout the entire experiment, which can pose challenges, particularly for children or individuals with motor impairments. Methodological challenges also arise when interpreting eye movement data, as the exact meaning behind a gaze fixation on a specific word may not always be straightforward, encompassing factors such as interest, comprehension, or difficulty in recognition.

Nonetheless, eye tracking remains a vital and financially accessible tool in the realm of neurolinguistic research, offering objective information about reading processes, speech comprehension, and speech production. Its non-invasive nature, real-time measurement capabilities, and alignment with natural reading behaviors make it a valuable methodological choice. However, it is crucial for researchers to carefully consider the limitations and complexities of eye tracking when designing experiments and analyzing data.

To conduct eye-tracking research, a standard experimental design involves formulating and testing hypotheses in an empirical and data-driven approach, with potential consideration for qualitative aspects. Typically, experiments involve a minimum of 20 participants, although the specific number may vary depending on the research objectives. The Central Limit Theory suggests that a sample size of 30 or more subjects can be representative when studying populations that cannot be entirely sampled (Salameh Jiménez, 2022). By embracing rigorous methodology and thoughtful analysis, eye tracking continues to contribute significantly to our understanding of the intricate relationship between visual attention and language processing.

Neurolinguistic methods and finding ways to improve foreign language learning efficiency

Neurolinguistic research, as mentioned above, involves studying the brain mechanisms involved in speech activities using various neurophysiological measurement and modeling techniques. Neurolinguistic methods provide objective information about how the brain processes language information at different levels, ranging from phonetics to semantics and pragmatics. They also shed light on how the brain adapts to new language systems during the process of learning foreign languages. Neurolinguistic methods can be utilized to analyze the effectiveness of foreign language learning and identify factors that

influence this effectiveness, such as age, motivation, language typology, individual characteristics, and more.

Among the most widely used and established neurolinguistic methods that have use in education-related research, the following main groups can be distinguished:

- Brain electrical activity measurement methods, which record changes in electrical potential on the surface of the head or inside the skull during brain stimulation with different types of information. These methods include electroencephalography (EEG), magnetoencephalography (MEG), event-related potentials (ERPs), and intraoperative cortical stimulation (ICS). These methods have high temporal resolution, enabling the precise determination of the exact time when a specific brain response to a stimulus occurs. However, they have low spatial resolution, making it challenging to precisely localize the brain region responsible for that response.
- Brain hemodynamic activity measurement methods, which record changes in blood flow or oxygen saturation in different brain areas during brain stimulation with various types of information. These methods include functional magnetic resonance imaging (fMRI), positron emission tomography (PET), single-photon emission computed tomography (SPECT), and functional near-infrared spectroscopy (fNIRS). These methods have high spatial resolution, allowing the precise localization of the brain region responsible for a specific response to a stimulus. However, they have low temporal resolution, meaning they cannot determine the exact timing of that response.
- Brain anatomical structure measurement methods, which capture the shape, size, and location of different brain areas or individual components. These methods include structural magnetic resonance imaging (sMRI), diffusion-weighted imaging (DWI), diffusion tensor imaging (DTI), and voxel-based morphometry (VBM). They provide information about the structural characteristics of the brain, such as gray and white matter volume, cortical thickness, integrity and direction of white matter, and more. Additionally, they reveal

how these characteristics are related to the functional aspects of the brain.

- Computer modeling methods, which utilize mathematical or computational models to describe or predict brain behavior during language information processing. These methods include connectionist models, symbolic models, Bayesian models, and dynamic systems. Such methods allow the testing of hypotheses regarding brain functioning based on experimental data or the simulation of foreign language learning processes while considering individual or group differences.

Neurolinguistic methods are useful for analyzing the effectiveness of foreign language learning from various perspectives:

- **Level of foreign language proficiency** - this refers to how well the learners master different aspects of a foreign language, such as phonetics, vocabulary, grammar or communicative skills. Neurolinguistic methods can measure the level of foreign language proficiency by using different criteria: the speed and accuracy of performing tasks in a foreign language; the activation of specific brain regions when performing tasks in a foreign language; the similarity or difference of brain activation when performing tasks in native and foreign languages; the change of brain activation during the learning process of a foreign language.
- **Learning style of a foreign language** - this reflects the preference of the learners for a certain type of information or mode of its presentation when learning a foreign language. For example, visual learners tend to favor images or various kinds of diagrams; auditory learners prefer sounds or speech; kinesthetic learners value movements or actions. Neurolinguistic methods can determine the learning style of a foreign language by using different criteria: the speed and accuracy of performing tasks in a foreign language depending on the type of information or mode of its presentation; the activation of specific brain regions when processing different types of information or modes of its presentation; the change of brain activation during the adaptation process to different types of information or modes of its presentation.

- **Learning strategies for a foreign language** - this involves the conscious selection and application by the learners of various techniques or methods to enhance the process and outcomes of learning a foreign language. For example, repetition, association, grouping, highlighting key words, self-control, etc. Neurolinguistic methods can measure the learning strategies for a foreign language by using different criteria: the speed and accuracy of performing tasks in a foreign language depending on the strategies used; the activation of specific brain regions when employing different strategies; the change of brain activation during the development or modification of strategies.

Neurolinguistic research can provide valuable insights into how people learn, process, and use foreign languages, as well as how to optimize teaching methods and materials for different learners. Some of the areas of possible neurolinguistic research aimed to improve teaching foreign languages are:

1. *Neuroplasticity and foreign language learning*: Neuroplasticity is the ability of the brain to change its structure and function in response to experience. Neurolinguistic research can investigate how foreign language learning affects neuroplasticity, and how neuroplasticity can facilitate or hinder foreign language learning. For example, research can explore how the age of onset, intensity, duration, and type of foreign language exposure influence the brain's adaptation to a new linguistic system; how foreign language learning affects cognitive functions such as memory, attention, and executive control; and how individual differences in neuroplasticity affect foreign language learning outcomes.

2. *Neural correlates of foreign language proficiency*: Neural correlates are the patterns of brain activity that are associated with a specific mental process or behavior. Neurolinguistic research can examine the neural correlates of foreign language proficiency, and how they differ from those of native language proficiency. For example, research can compare the brain activation of native and non-native speakers when performing various linguistic tasks in their respective languages; identify the brain regions that are involved in different aspects of foreign language proficiency, such as phonetics, vocabulary, grammar, or communicative skills; and investigate how the neural

correlates of foreign language proficiency change over time or with different levels of proficiency.

3. *Neural predictors of foreign language learning success*: Neural predictors are the indicators of brain activity that can predict a future outcome or performance. Neurolinguistic research can discover the neural predictors of foreign language learning success, and how they can be used to optimize teaching strategies and interventions. For example, research can measure the brain activity of learners before, during, or after a foreign language learning session or course; identify the brain features that are related to successful or unsuccessful foreign language learning; and design personalized or adaptive teaching methods based on the learners' neural profiles.

These are just some examples of the areas of possible neurolinguistic research aimed to improve teaching foreign languages. Neurolinguistic research can contribute to a better understanding of the cognitive and neural mechanisms underlying foreign language learning, as well as to a more effective and efficient teaching practice.

Therefore, neurolinguistic methods offer a unique opportunity for evaluating the effectiveness of learning foreign languages, as well as for identifying individual or group differences in this process. Neurolinguistic methods can be applied both for scientific research purposes and in practical terms (diagnosis of the level of proficiency in a foreign language, selection of the optimal methodology for teaching a foreign language, correction of speech disorders or dysfunctions related to learning foreign languages).

Conclusion

The integration of neurolinguistic methodology into teaching English as a foreign language (TEFL) and enhancing professional communication has the potential to revolutionize language learning and elevate communication skills to new heights. By delving into the intricate workings of the brain's language processing mechanisms, educators and professionals can leverage this knowledge to design more effective instructional strategies and training programs.

Neurolinguistic methods offer valuable insights into how the brain perceives, processes, and adapts to linguistic information. Through advanced neurophysiological measurements and computational modeling, researchers can uncover the cognitive processes and neural networks involved in language acquisition. This understanding allows

educators to tailor their teaching approaches, aligning them with the brain's natural language learning capacities. By capitalizing on these insights, instructors can create engaging and impactful English language curricula that resonate with learners on a neurological level.

Furthermore, neurolinguistic methodology addresses the specific challenges faced by adults aiming to improve their English communication skills in professional settings. By considering individual differences, motivation, and cognitive processing, targeted interventions can be developed to enhance workplace communication proficiency. Neuroimaging techniques provide valuable data on the neural substrates associated with successful professional communication, enabling the development of specialized training programs tailored to meet the unique needs of adult learners.

The transformative potential of neurolinguistic methodology lies in its ability to bridge the gap between neuroscience and language education. By leveraging the brain's innate language processing capabilities, educators and professionals can unlock new avenues for effective language learning and professional communication. As the field continues to advance, it is crucial for researchers, educators, and professionals to collaborate and explore innovative applications of neurolinguistic methodology in language pedagogy and professional development.

By embracing this interdisciplinary approach, we can foster a more engaging, personalized, and efficient learning experience for language learners while equipping professionals with the skills necessary to thrive in globalized workplaces. The future of language education and professional communication holds immense promise, and it is through the integration of neurolinguistic methodology that we can unlock its full potential.

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ВАРИАТИВНОЕ ПАДЕЖНОЕ МАРКИРОВАНИЕ В ПУБЛИЦИСТИЧЕСКОМ ДИСКУРСЕ ГЕРМАНИИ

Данная работа посвящена проблеме синтаксической организации именных групп с первым компонентом, обозначающим названия групп животных, а именно Rudel (стая), Schwarm (рой), Herde (стадо). Интерес к словосочетаниям данного типа обусловлен возросшей частотностью употребления в публицистике Германии, а также особенностями синтаксического построения. Корпус публицистических текстов позволил увидеть количественное распределение моделей, при помощи которых оформлены словосочетания типа ein Rudel Wölfe (стая волков), а

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